

Use of dual-polarization radar variables to assess low-level wind shear in severe thunderstorm near-storm environments in the Tennessee Valley

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The upgrade of the National Weather Service (NWS) network of S-band dual-polarization radars is currently underway, and the incorporation of polarimetric information into the real-time forecasting process will enhance the forecaster's ability to assess thunderstorms and their near-storm environments. Recent research has suggested that the combination of polarimetric variables differential reflectivity (ZDR) and specific differential phase (KDP) can be useful in the assessment of low level wind shear within a thunderstorm. In an environment with strong low-level veering of the wind, ZDR values will be largest along the right inflow edge of the thunderstorm near a large gradient in horizontal reflectivity (indicative of large raindrops falling with a relative lack of smaller drops), and take the shape of an arc. Meanwhile, KDP values, which are proportional to liquid water content and indicative of a large number of smaller drops, are maximized deeper into the forward flank precipitation shield than the ZDR arc as the smaller drops are being advected further from the updraft core by the low level winds than the larger raindrops.

Using findings from previous work, three severe weather events that occurred in North Alabama were examined in order to assess the utility of these signatures in determining the potential for tornadic activity. The first case is from October 26, 2010, where a large number of storms indicated tornadic potential from a standard reflectivity and velocity analysis but very few storms actually produced tornadoes. The second event is from February 28, 2011, where tornadic storms were present early on in the event, but as the day progressed, the tornado threat transitioned to a high wind threat. The third case is from April 27, 2011, where multiple rounds of tornadic storms ransacked the Tennessee Valley. This event provides a dataset including multiple modes of tornadic development, including QLCS and supercell structures. The overarching goal of examining these three events is to compare dual-polarization features from this larger dataset to previous work and to determine if these signatures can be a useful indication of the potential for tornadic activity associated with the amount of low-level wind shear in the near-storm environment.